REMARKS

The Office Action

In the Office Action dated April 5, 2005, claims 23 and 24 and 26-33 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,327,955 of Easwaran in view of U.S. Patent No. 5,641,015 of Challand. Claims 25, 34-41 and 43 were rejected under 35 U.S.C. §103(a) as being unpatentable over Easwaran in view of Challand and in further view of either the Pineda et al. 6,551,396 patent (Pineda), the Sahari 5,158,130 patent or the Conroy et al. 5,915,452 patent (Conroy). Claims 1-17, 22, 44 and 45 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Easwaran in view of Challand and in further view of Carter and Pineda. Claims 18 and 19 were rejected as being unpatentable over Easwaran in view of Challand and in further view of Carter, Pineda and Conroy. Claims 20, 21, and 42 were rejected as being unpatentable over Easwaran in view of Challand and in further view of Carter, Pineda and U.S. Patent No. 4,580,616 to Watts.

The Examiner is thanked for the courtesy of providing an interview to the Applicants and their attorney on July 5, 2005. During the interview, a discussion was had concerning certain proposed changes to the claims. A discussion was also conducted concerning the art of record, particularly Carter and Pineda.

Independent claim 1 was rejected as being unpatentable over Easwaran in view of Challand and in further view of Carter and Pineda. It was admitted that Easwaran in view of Challand failed to teach the use of rapid cooling and removing a portion of a water dispersible mold. It was asserted that Carter teaches the use of rapid cooling, such as simultaneous molten metal pouring and immersion cooling for the purpose of forming a fine grain and reducing oxidation pitting for casting. Pineda was said to teach the use of dropping the mold into water in order to remove or crack a portion of the water dispersible mold. The Office Action went on to assert that it would have been obvious to one having ordinary skill in the art to provide Easwaran in view of Challand the use of rapid cooling and removing or cracking a portion of the water dispersible mold as taught by Carter and Pineda in order to reduce cycle time of casting and to refine the grain size. This rejection is respectfully traversed.

It was pointed out during the interview that Carter particularly teaches the immersion

of its shell mold 20 into its bath 22 "until the molten metal therein solidifies and preferably for some time interval thereafter" since this "is important in the practice of the invention" (see col. 3, lines 48-51). It was also noted that Carter particularly teaches that his shell "must be self-supporting in the sense that it can be moved into the liquid coolant" (see col. 4, lines 32-34). Carter further teaches that his poured mold, with the metal in it still in a fluid condition, should be immersed in the body of liquid 22 and that it should be maintained in the liquid until the molten metal solidifies (see col. 3, lines 26-27). The purpose given in Carter for immersing molten metal, held in a mold, in a liquid bath is that the bath has very high heat transfer properties. Carter particularly notes that the liquid used as a coolant "acts essentially to conduct heat away from the mold and establish a controlled cooling rate" (see col. 2, lines 61-63). Thus, cooling in Carter takes place through the mold.

But, there is no teaching or disclosure in Carter of removing at least a portion of the mold during the process of cooling the molten metal, prior to complete solidification of the molten metal into a casting. In this connection, claim 1 recites the step of cooling the molten metal such that it only partially solidifies into a casting and removing at least a part of the mold. Accordingly, it is respectfully submitted that Carter fails to teach the step of only partially solidifying the molten metal into a casting and the step of removing at least a part of the mold, as recited in claim 1.

Pineda is similarly deficient. The disclosure in Pineda is to various phosphate bonded compositions and molds. But, Pineda particularly discusses the use of the mold to make an investment casting. Not only is the casting allowed to cool down, so is the mold in Pineda. Only after the mold itself is allowed to cool (see col. 6, line 24 of Pineda) is the mold removed. Such removal is by grinding, sandblasting or the like (see col. 6, line 25). Pineda particularly teaches sandblasting with glass beads (see col. 6, lines 27-28). Alternatively, Pineda teaches dropping the mold into water to create a heat differential between the inner and outer surfaces of the mold to crack the mold (see col. 6, lines 29-31). What is clearly missing from Pineda, as it was from Carter, is any teaching or disclosure of removing at least a part of the mold prior to complete solidification of the molten metal in the mold into a casting.

That teaching is similarly missing from Easwaran or Challand. In Easwaran the teaching is to holding a solidifying metal at an elevated temperature, usually from 800° to

1650°F (see col. 5, line 62) for an extended period of time, typically from 10 to 15 minutes (see col. 3, line 64) before the casting is removed. Thus, what is removed is an "as cast" metal part (see col. 6, line 5). In the first example in Easwaran, steel is held for 15 minutes at 1600°F before the shell is removed by shot blasting (see col. 6, lines 41-44). Similarly in example 2, the steel casting is held at 1650°F for 15 minutes before a water jet is applied to it. In example 3, a ductile iron casting is maintained at a temperature of 1000°F for 10 minutes and then is air cooled prior to blasting to remove a ceramic shell (see col. 7, lines 39-41). Finally, in example 4 a frozen aluminum casting is held at 900°F for 10 minutes before being transferred to a water jet cleaning system. In all of these examples, Easwaran fully solidifies the molten metal into a casting before removing at least a part of the mold. This is in contrast with claim 1.

Finally, Challand teaches a core or mold which maintains its shape throughout the casting process (see col. 1, lines 58-59). Challand's objective is to remove excess water from the mold to ensure that there is no degradation of the mold or core due to the presence of such excess water (see col. 6, lines 30-32). Challand teaches that the removal of the mold is to take place after casting (see col. 9, lines 45-46). But, there is no teaching or disclosure in Challand of cooling a molten metal, such that it only partially solidifies into a casting, and removing at least a part of the mold.

In sum, there is no teaching in any of the applied four references of Easwaran, Challand, Carter and Pineda, or any combination thereof, of a process for lost pattern casting of metals which comprises, among other steps, cooling the molten metal such that it only partially solidifies into a casting and removing at least a part of the mold, as recited in claim 1. Therefore, claim 1 is patentable over the applied combination of references, as well as the remainder of the cited art.

Dependent claims 2-6, 9-11 and 13-22 merely further patentably define the detailed subject matter of their parent claim or each other. As such, these claims are also believed to be in condition for allowance over the art of record.

Independent claim 44 was rejected on the same grounds as claim 1. Claim 44 recites a process for the lost pattern casting of metals including the steps of a) cooling the molten metal such that it partially solidifies to form a partially solidified casting; b) contacting the backing and the mold with the solvent to decompose at least a part of the backing and at least a part of the mold; and c) contacting the casting with the solvent to

further solidify the casting. There is no teaching or disclosure of such a process in any of Easwaran, Challand, Carter and Pineda, or their combination. In sum, none of these four references teaches or discloses a) forming a partially solidified casting b) contacting a backing and a mold with a solvent to decompose a part of the backing and at least a part of the mold and then c) contacting the casting with solvent to further solidify the casting.

Accordingly, claim 44 is in condition for allowance over the applied four way combination of references, as well as the remainder of the cited art.

Dependent claim 45 further patentably defines the detailed subject matter of its parent claim. As such, this claim is also believed to be in condition for allowance over the art of record.

Applicant herewith submits new dependent claim 46. This claim recites that in the process of claim 44 the molten metal comprises aluminum and the solvent comprises water.

There is no teaching or disclosure in any of the applied or cited art of a process for the lost pattern casting of metals, wherein the molten metal comprises an aluminum, which is partially solidified into a casting, and contacting the backing and the mold with a solvent comprising water, to decompose at least a part of the backing and at least a part of the mold, and then contacting the casting with the solvent to further solidify the casting. None of the cited or applied art teaches a process in which a partially solidified casting, including a molten metal which comprises aluminum, is contacted with the solvent, which comprises water, prior to complete solidification of the casting. Accordingly, claim 46 is also believed to be in condition for allowance over the art of record.

With further reference to the Office Action, and paragraph three thereof, it was noted that claims 23, 24, and 26-33 were rejected as being unpatentable over Easwaran in view of Challand. It was stated that Easwaran teaches a shell mold produced by forming a polystyrene foam pattern with the use of gates and risers and forming an aggregate coating on the pattern and an aggregate backing around the coated pattern, wherein the backing is contained in a container or flask. It was admitted that Easwaran did not teach the use of a water-soluble binder for forming an erodable coating and an erodable backing. Challand was said to teach the use of a water-soluble binder including polyphosphate chains and/or borate ions and silica sand, for the purpose of forming a water dispersible mold including an erodable coating and an erodable backing in casting metal, without the

need of a container or a flask because the backing is self supporting or free standing when the binder is used. The Office Action asserted that it would have been obvious to one having ordinary skill in the art to provide Easwaran the use of a water-soluble binder, as taught by Challand, in order to effectively form a water-soluble mold including an erodable coating on the pattern and an erodable self support or free standing backing around the coated pattern.

In Applicants' view, it would not have been obvious to combine Easwaran with Challand, absent the teaching to be found in Applicants' claims. Challand pertains only to water dispersible molds for making castings in which a fine particulate refractory is added to the mold composition in order to improve the strength and related properties of the mold when it is hot, prior to casting. There is no intimation in Challand that it can be used in a lost pattern mold, such as is disclosed in Easwaran. Rather, Easwaran merely teaches the conventional technique of employing a flask, in which is contained a loose aggregate. As noted during the interview, there is no teaching in Easwaran of forming a water dispersible mold or lost pattern mold from an aggregate which is erodible by a solvent wherein the mold is positioned around at least a portion of the pattern.

In Challand, foundry sand and a binder is combined with at least one fine particulate refractory material. Challand teaches that the fine particulate refractory results in improvements in the strength of the mold when it is hot, prior to casting. But, in Challand, the mold is not removed until after the cast metal is completely solidified. Challand particularly notes that removal of the mold after casting can be carried out by soaking the casting in a water bath and then flushing the casting with water (see column 9, lines 45-47). Completely solidifying the cast metal before removal of the mold is assumed in Challand. It is standard practice in the industry.

As noted during the interview, there is no teaching or disclosure in even the combination of Easwaran and Challand of an assembly for the lost pattern casting of metals wherein a mold comprises an aggregate formed from a particular material and a binder, wherein the aggregate is erodable by solvent, and a pattern, wherein the mold is positioned around at least a portion of the pattern.

Accordingly, it is respectfully submitted that independent claim 23 patentably defines over the applied combination of references, as well as the remainder of the cited art.

Dependent claims 24, 26-29 and 31-33 merely further patentably define the detailed

subject matter of their parent claim or each other. As such, these claims are also believed to be in condition for allowance over the art of record.

Dependent claim 25 was rejected as being unpatentable over Easwaran in view of Challand and in further view of Pineda, Sahari or Conroy. Easwaran in view of Challand was admitted to not teach the use of controlling the dose of binder or the use of a water nozzle. It was stated that Pineda teaches the use of controlling and reducing the binder and increasing silica sand, for the purpose of making the investment softer and easier to remove from the casting metal. Sahari was said to teach the use of a water jet. Conroy was said to teach the use of nozzles. However, even the applied combination of references neither teaches nor discloses the subject matter which is recited in claim 25. As such, this claim is allowable over the art of record.

Independent claim 35 was rejected as being unpatentable over Easwaran in view of Challand and further in view of Pineda, Sahari or Conroy. Claim 35 recites an apparatus for the lost pattern casting of metals whereby a lost pattern is at least partially eroded and a molten metal in the mold is cooled and solidified by contact with a solvent to form the casting wherein the solvent erodes at least a part of the mold and the backing, the solvent being delivered via a nozzle.

It was stated in the Office Action that Easwaran in view of Challand fails to teach the use of a water nozzle. Sahari was said to teach the use of nozzles and submerging the mold into water for the purpose of cooling and removing the casting and reusing the binder agent. Conroy was said to teach the use of nozzles and flow rate and pressure of fluid including water and surfactant for the purpose of removing cores from castings. The Office Action asserted that it would have been obvious to one having ordinary skill in the art to - provide Easwaran in view of Challand the use of a water nozzle as taught by either Pineda, Sahari or Conroy in order to effectively make the backing investment softer and easier to remove from the casting metal or to rapidly cool the casting molten state and remove or crack the water soluble mold from the casting. This rejection is respectfully traversed.

As a preliminary matter, Applicant does not agree that it would have been obvious to combine Easwaran with Challand for the reasons stated above. Secondly, even if they were combined, it wouldn't be obvious to provide an apparatus including a nozzle for delivering a solvent with the solvent eroding at least a part of the mold and the backing. Claim 35 recites that the nozzle delivers solvent to contact at least a part of the mold and a

part of the backing, the solvent eroding at least a part of the mold and the backing before the molten metal is fully solidified. As noted above, there is no teaching or disclosure of such an apparatus in any of the cited art. Accordingly, claim 35 is in condition for allowance over the art of record.

Dependent claims 36-43 merely further patentably define the detailed subject matter of their parent claim or each other. As such, these claims are also believed to be in condition for allowance over the art of record.

CONCLUSION

In view of the foregoing, it is respectfully that all of the pending claims are in condition for allowance over the art of record. Such allowance is earnestly solicited.

Respectfully submitted,

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August 4, 2005
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CERTIFICATE OF MAILING

Under 37 C.F.R. § 1.8, I certify that this Amendment A is being deposited with the United States Postal Service as First Class mail, addressed to: MAIL STOP AMENDMENT, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on the date indicated below.

	Signature
Date **August 4, 2005**	**Printed Name** **Kathleen A. Nimrichter**